Author Index

Alexander, W. M. 509, 729
Anderson, Jr., C. E. 1, 85, 551
Ang, J. A. 13, 95
Angel, Y. C. 25
Ari, N. 37
Atkinson, D. 49

Babcock, S. M. 695
Bahk, S. 61
Baker, J. R. 73
Bar-Noy, T. 279
Bareiss, L. 479
Bernhard, R. P. 347
Bless, S. J. 85
Blossom, A. A. Hopkins 719
Boslough, M. B. 95
Budge, K. G. 107
Burkett, M. W. 819

Chapyak, E. J. 863
Charvet, E. 467
Chau, H. 451
Chavez, D. 61
Chhabildas, L. C. 95, 121, 133
Christiansen, E. L. 95, 145, 157, 169
Cintala, M. J. 347
Collopy, M. T. 719
Colton, J. D. 597
Cook, W. H. 373
Cooper, T. 181
Cour-Palais, B. G. 95, 193
Crawford, D. A. 205
Crews, J. L. 95
Culp, R. D. 479
Curling, Jr., H. L. 719, 775
Curtis, J. P. 217
Cykowski, E. 157

Dahl, K. V. 193
Davidson, R. F. 819
Dickinson, D. L. 831
Dunn, J. E. 121

Eliezer, S. 279
Emery, B. 61
Englman, R. 279

Fahrenthold, E. P. 229
Finnegan, S. A. 241
Franzen, R. R. 551
Frey, J. D. 255
Fuerstenau, S. 719
Furnish, M. D. 267

Gallagher, P. J. 809
Garaud, X. 255
Gerassimenko, M. 451
Gilath, I. 279
Gillespie, T. G. 479
Gillis, P. P. 503
Gilman, J. J. 291
Gosling, S. M. 13
Grace, F. I. 303
Grady, D. E. 427, 851
Gratz, A. J. 531
Griffiths, D. J. 751
Groenenboom, P. 255
Grosch, D. J. 315, 763

Hall, C.A. 95
Hansche, B. D. 13
Hatfield, S. L. 503
Hatt, D. J. 785
Heimdahl, O. E. R. 241
Helba, M. J. 519
Held, B. J. 619
Henninger, R. 491
Hertel, E. S. 133
Hickman, R. J. 13
Hill, S. A. 133
Hohler, V. 325, 797
Holsapple, K. A. 335
Hörz, F. 347
House, J. W. 407, 503
Humphrey, J. W. 695

Idzorek, G. C. 719, 775
Igenbergs, E. 587
Isbell, W. M. 359

Jaeger, Z. 279
Janicot, F. 255
Johnson, G. R. 373, 385
Johnson, M. S. 739
Jolly, W. H. 395
Jones, S. E. 407

Kerr, J. H. 169
Kerrisk, J. F. 417
Kipp, M. E. 427
Konrad, C. H. 13
Kustas, F. M. 479

Lambert, M. 255
Lawrence, R. J. 439, 851
Lee, T.-S. 325
Lee, R. 451
Levadou, F. 631
Leyrat, J. P. 467
Lindfors, A. J. 241
Littlefield, D. L. 1

Maag, C. R. 729
Maclay, T. D. 479
Majerus, M. E. 551
Mandell, D. A. 491
Marlow, R. B. 407
Mayes, J. L. 503
McDonald, R. A. 509, 729
Meier, J. K. 417
Miller, J. M. 121
Mog, R. A. 519
Mullin, S. A. 763

Nahme, H. 325
Nellis, W. J. 531
Nolen, A. M. 541

Olsen, G. D. 541
Orphal, D. L. 551
Ortega, J. 157
Osher, J. 451

Peery, J. S. 107
Persechino, M. A. 73, 561
Petersen, E. H. 385
Piekutowski, A. J. 193, 573
Pomykal, G. 451
Poormon, K. L. 193
Pringle, J. K. 241
Pujols, H. C. 467

Reinhart, W. D. 95, 121
Reschauer, W. 587
Riegel, J. P. 315, 843
Robinson, J. H. 519
Rott, M. 631

Sanai, M. 597
Saravane, I. 607
Savick, D. S. 619
Scheer, S. A. 671
Schmidt, E. M. 619
Schneider, E. 631
Schneidewind, P. N. 551
Schonberg, W. P. 637, 647
Schultz, P. H. 205, 659
Schulz, J. C. 241
Schwehm, G. 631
See, T. H. 347
Shafer, B. P. 719, 775
Shephard, G. L. Y. 671
Simon, C. G. 683
Smith, J. P. 25
Sobota, T. H. 695
Speer, R. 451
Stellingwerf, R. F. 707, 819
Stilp, A. J. 325, 631, 797
Stoltzfus, J. 61
Stradling, G. L. 719, 775
Stryk, R. A. 385
Sweatt, W. C. 13
Swegle, J. W. 427

Tanner, Jr., W. G. 509, 729
Tedeschi, W. J. 359
Tham, R. 325
Thompson, L. E. 739
Trott, W. M. 439
Tsou, P. 751

Walker, J. D. 1, 551, 763
Walsh, J. M. 775
Wang, J.-P. 325
Waschl, J. A. 785
Watts, A. 49
Weber, K. 325, 797
Weickert, C. A. 809
Wilbeck, J. S. 37
Williams, A. E. 561, 607
Williamsen, J. E. 395
Wilson, B. 61
Wilson, L. L. 407
Wingate, C. A. 707, 819

Yang, F. 647
Yatteau, J. D. 831
Yaziv, D. 843
Yeh, Y.-K. 325
Yew, C. H. 851

Zernow, L. 863

Subject Index

ablation pressure, 279
absorption coefficient, 439
acceleration, 121, 315
accelerator
  electric gun, 451
  energy deposition--laser, 279
  exploding bridge foil, 785
  scram accelerator, 695
advection, 107
aerodynamics
  free-flight, 619
aerogel, 683
aluminum
  see projectile, target
aluminum oxide
  see target
aluminum oxide film, 61
angular impulse, 561
angular momentum, 561
Arbitrary Lagrange-Euler, 107, 255
atmospheric erosion, 763
atmospheric interactions, 659

backsplash, 451, 797
ballistic limit, 25, 73, 145, 169, 395, 637, 647
blow off, 439, 451
bonding energy, 291
bulging, 279
bumper shield, 25, 37, 95, 133, 145, 157, 229, 255, 395, 479, 519, 541, 573, 637, 647, 671, 707, 851
bumper shield
  areal density, 739
  dual wall, 395
  mesh double bumper, 95, 145, 169, 479
  multi-shock, 95, 145, 193, 229, 255, 479, 519, 541, 739
  optimization, 479
  projectile shape, 95
  shield design, 145, 169, 193, 541, 647
  thickness effect, 395
  wall spacing, 519
BUSSL, 729

cadmium, 335
carbon fiber/epoxy, 279
ceramic
  aluminum oxide, 85, 181, 491
  aluminum oxide film, 61
  boron carbide, 491
  silicon carbide, 491
  titanium diboride, 491
ceramic cloth
  see target
ceramics
  see target
chemical bonding, 291
compressibility, 1
concrete, 385
copper
  see projectile, target
coupling efficiency, 439
covalent bonding, 291
cracking, 49
crater damage, 157
crater diameter, 73, 347, 819
crater shape, 1, 157
crater volume, 587, 607
cratering, 49, 205, 255, 325, 347, 587, 659, 719, 729, 775, 819
cratering
  atmospheric effects, 659
  crater growth, 659
  critical angle, 157
  diameter, 325, 551
  LDEF, 157
  lunar, 157
  magnetism, 205
  oblique impact, 157
  penetration, 325
  scaling, 719, 775
  velocity dependence, 551
  volume, 325
crystalline olivine, 683
cylindrical convergence, 181

damage, 279, 503
damage
  brittle materials, 279
  ductile materials, 279
damage class, 169, 671
DDT, 241
debris
  charge, 587
  expansion velocity, 427
  mixed phase, 707
  particle size, 427
  residual velocity, 427
debris bubble, 241
debris cloud, 13, 25, 37, 95, 133, 229, 255, 395, 427, 479, 607, 671, 739, 797, 851
debris cloud
  debris velocity, 95
  dispersion, 607, 831
  dynamics, 573
  expansion, 325, 607
  expansion velocity, 325, 573, 797, 851
  formation, 573
  fragment distribution, 37
  fragment number, 37
  fragmentation, 607
  geometry, 325
  impact velocity effects, 573
  mass distribution, 37

modeling, 647
plate thickness effects, 573
radial velocity, 851
spray angle, 37
debris clouds, 573
debris formation, 133
debris generation, 359
debris morphology, 683
debris particle
trajectory distribution, 831
velocity distribution, 831
decomposition energy, 439
defect formation, 279
depleted uranium
see projectile
detector
capture cell, 49, 683, 729
charge, 587
holography, 13
impact, 587
impact flash, 315, 587, 683
plasma velocity, 683
PVDF thin film, 683
VISAR, 267
diagnostic systems, 359
dislocation motion, 291
dolomite, 205
DOP test, 85
dual-wall
see bumper shield
ductility, 291, 863

EFP, 809
electron delocalization, 291
emission line spectra, 751
energetic materials, 241
energy deposition, 439
energy partitioning, 1
epoxy, 719
equation of state, 267, 451, 531
exothermic reaction, 241
expansion velocity, 427, 851
exploding bridge foil, 785
explosive launcher, 181, 467, 763
explosive simulation, 597
explosive volcanism, 531
explosively formed projectile, 809

failure, 279
fast shock tube, 417
fluence, 439
flyer plate, 181, 785
flyer plate
acceleration, 439
fracture, 255, 279, 385, 417, 427, 491, 707, 851
fragment distribution, 37
fragment launcher
fast shock tube, 417
flyer plate, 121
shaped charge, 763
fragment mass, 607
fragment number, 37, 607
fragment simulator, 597
fragmentation, 13, 37, 49, 157, 229, 255, 325, 427, 573, 607, 707, 831, 851
free Lagrange, 181
fullerenes, 531

geologic materials, 267
geologic materials
see target
glass
see projectile, target
glide activation energy, 291
gold
see target
grain structure, 863
granite, 531
graphite epoxy, 607
gun dynamics, 315, 619
Gurney theory, 439

hole formation, 597
hole growth, 509
hole size, 73, 347, 509, 587, 631, 637, 671, 739, 797, 831
holography, 13
Hugoniot, 267, 451, 531

ignition, 61
ignition temperature, 61
image analysis, 13
image reconstruction, 13
image reconstruction
resolution limits, 13
impact flash, 315, 587, 797
impulse
angular, 561
impulse gain, 451
impulse generation, 439
impulse loading, 831
inhibited shaped charge, 763
intact capture, 683, 751
intact recovery
see soft recovery
ionization, 205, 587
iron
see projectile
isentropic compression, 121

jet incoherence, 763

kapton
see projectile

L/D effects, 551
laser interaction, 439
launch dynamics, 121, 315, 417, 619
launcher, 359
launcher
  exploding bridge foil, 785
  explosive cylinder, 467
  modified two-stage, 121
  plasmadynamic, 587
  scram accelerator, 695
  two-stage light-gas gun, 315
  Van de Graaff, 719
LDEF, 49, 157, 347, 631, 729
light-gas gun, 315
luminescence, 587
lunar craters, 157

magnetic fields, 205
magnetism, 205
magnetohydrodynamics, 205
material synthesis, 531
melting, 451, 707
melting
  see phase transformation
metastable phases, 531
micrometeoroids, 359
microparticle
  see projectile
microstructure, 531
mixture theory, 229
modeling
  BRDF, 49
modeling
  brittle material response, 49
  bulging, 279
  Cour-Palais, 49
  cracking, 49
  damage, 279, 417, 503
  debris clouds, 851
  debris environment, 49
  electrical Gurney, 785
  explosive launch, 181
  fragment simulator, 597
  fragmentation, 37, 427, 851
  Grady-Kipp, 37
  Gurney, 439
  impulse gain, 451
  Johnson spall, 417
  Johnson-Cook damage, 417
  Johnson-Holmquist model, 491
  Kessler model, 49
  laser interaction, 439
  late stage equivalence, 719, 819
  magnetohydrodynamics, 205
  mixture theory, 229
  momentum enhancement, 451
  optical scatter, 49
  optimization, 315, 467
  see penetration modeling
  PCLGGP, 315
  RASCAL, 619
  shock pressure decay, 279
  Steinberg ceramic model, 491
  strength, 775, 819
  stress wave propagation, 279
  TIS, 49
molecular dynamics, 509
momentum enhancement, 451
multi-bumper, 519
multi-particle penetration, 831
multi-shock shield
  see bumper shield
muzzle blast, 619

numerical simulation
  advection, 107
  ALE, 107, 255
  bumper shield, 479, 707
  CALE, 763, 819
  CEL, 467
  code linking, 229
  constitutive response, 385, 707
  cratering, 157, 325, 551, 809
  CSQ, 551
  CSQIII, 241
  CTH, 1, 133, 157, 229, 303, 427, 479, 509, 551, 729
  debris cloud, 37, 133
  DYNA2D, 229
  EFHYD, 255
  EFP, 809
  EPIC, 373, 385, 763, 819
  fracture, 385, 427
  fragmentation, 427
  free Lagrange, 181
  hole formation, 597
  hole size, 509
  HULL, 37
  JOY, 451
  L2D, 181, 597
  long-rod penetration, 1
  LS-DYNA2D, 325
  MESA, 417, 491, 819, 863
  mesh sensitivity, 491
  mixture theory, 229
  molecular dynamics, 509
  oblique impact, 37, 157, 373, 707
  penetration, 1
  PLEXUS, 467
  projectile shape, 133
  RHALE, 107
  Riemann shock problem, 707
  short L/D, 551

SMERF, 241
SPH, 385, 707, 819
SPHINX, 707
tensile fracture, 491
void, 229
yawed impact, 373
ZeuS, 61, 157, 809
nylon
see projectile

oblique impact, 37, 73, 157, 373, 395, 561, 637, 647, 671, 707
optical scatter, 49
optimization, 479, 519
orbital debris, 359

particle shape, 531
particle size, 531
particle size distribution, 427
penetration, 145, 169, 809
L/D effect, 551
long-rod, 1, 217
primary, 1
residual, 1
secondary, 1
shaped charge, 217
steady-state, 1
unsteady, 1
velocity dependence, 1, 551
velocity effect, 1, 325, 551
velocity history, 1, 551
penetration efficiency, 85, 217, 551
penetration modeling, 647
angular momentum, 561
area removal, 831
Baker, 561
crater diameter, 73
cratering, 729
critical impact velocity, 303
debris cloud, 25, 647
debris cloud damage, 831
debris cloud loading, 647
debris dispersion, 831
empirical fit, 157
FATEPEN, 831
finite-thickness effects, 843
hole size, 73, 831
hydrodynamic, 217
hydrodynamic limit, 1
hydrodynamic theory, 1
impulse, 561
impulse loading, 831
Jones-Gillis-Foster, 407
KAPP code, 597
long-rods, 303
see modeling
MITI, 843
multi-bumper, 519
nonsteady, 303
obliquity, 73
off-axis velocity, 217
one-dimensional, 407
optimization, 519
phases of impact, 1
plate damage, 831
radial velocity, 217
regression analysis, 519
residual length, 561
rotation rate, 561
shear strength, 561
shield design, 25, 145, 169, 193, 395, 647
short L/D, 551
statistical approach, 217
steady-state, 1, 85, 843
strain, 407
target resistance, 1, 85
Tate, 1, 85
Tate resistance, 1, 85
thermal softening, 843
thickness effects, 25, 73, 145, 169, 395, 541, 647
thin films, 729
trajectory distribution, 831
tumbling, 561
unsteady penetration, 407
velocity distribution, 831
Wilkinson Predictor, 519
witness plate damage, 831, 1, 303
perforation, 25, 145, 157, 169, 325, 347, 373, 395, 561, 587, 637, 647, 831
perforation
thickness effects, 347, 519, 587, 607, 637
petalling, 637
phase change,
vaporization, 587
phase transformation, 95, 133, 193, 205, 255, 291, 335, 451, 479, 531, 573, 683, 729, 739, 797
phase transformation
vaporization, 819
plasma, 205
plastic
see projectile
plasticity, 291, 503, 863
plate deflection, 25, 647
porosity, 751
pressure distribution, 407
pressure wall, 637
primary penetration, 1
projectile
acceleration, 417
projectile

aluminum, 25, 49, 95, 107, 121, 145, 169, 205, 229, 255, 479, 509, 519, 541, 607, 631, 637, 647, 659, 729, 751, 763, 797
aluminum oxide, 49
aluminum rod, 385
aluminum--2017, 73
aluminum--2017-T4, 157, 193, 573
aluminum--2017-T3, 671
aluminum--2024-T3, 407
aluminum--2024-T86, 561
aluminum--6061-T6, 133
aluminum-2024, 467
Armco iron, 809
chunky, 37, 597
compact fragment, 831
copper, 13, 467, 503, 819, 863
copper disc, 851
copper rod, 385
crystalline olivine, 683
cylinder, 169, 325
disk, 707
DU, 85, 373, 843
EFP, 809
fin stabilized, 619
flare stabilized, 619
flat plate, 95, 417
flyer plate, 121
fragmentation, 417
glass 145, 587, 631, 683
graphite epoxy, 607
integrity, 417
iron, 519, 631, 719, 729, 775, 819
kapton, 785
kapton membrane, 451
L/D effects, 551
long-rod, 85, 107, 619
low L/D, 407
magnesium, 95, 121
microparticle, 61, 315, 347, 587, 683, 719, 775, 819
microparticles, 49, 631, 729
mushrooming, 407
nylon, 169, 671
ogive, 241
orbital debris, 359
plastic, 145
plate, 133
polyetheline, 659
residual length, 561
rod, 707
rods, 561
shape, 809
shape effects, 133
short cylinder, 607
short L/D, 325, 551
short rods, 407
soda-lime glass, 347
sphere, 133, 157, 169, 241, 395, 573, 597, 637, 671, 707, 797, 831
stabilize, 619
steel, 13, 145, 169, 241, 303, 385, 831
steel--4340, 407, 561
steel--9SMn28, 325
steel--C1015, 407
steel--E51200, 427
thin flyer, 451
titanium, 121
tungsten, 1, 37, 85, 303, 407, 491, 551, 597, 843
projectile rotation, 561
projectile tumbling, 561
pulsed laser, 279
pyrolization, 751
pyrolytic graphite, 719

radiation
gray body, 751
recovery experiments, 531
release, 267
release temperature, 451, 797
residual penetration, 1
residual projectile
length, 561, 843
rotation, 561
velocity, 561, 843
Riemann shock problem, 707
rocket motor, 241

sabot, 315, 619, 695
discard, 619
scaling, 335, 607, 719, 775, 819
SDT, 241
secondary debris, 671
secondary penetration, 1
semiconductors, 291
shaped charge, 467, 763, 863
atmospheric erosion, 763
coherence, 763
collapse, 863
fragment launcher, 763
inhibited, 763
jet tip, 763
jet tip velocity, 763
off-axis velocity, 217
shear strength, 561
shield design, 395
TMB, 479
shock heating, 751
shock initiation, 241
shock recovery, 531
shock tube, 417
shock wave
wave shaping, 181
shock wave damage, 279

similarity, 335
smooth particle hydrodynamics, 385, 707
soda-lime glass, 347
soft recovery, 863
soft recovery
  see intact recovery
spaced targets, 373
spallation, 279, 587, 637
spectroscopy, 751
steady-state penetration, 1
steel
  see projectile
strain, 863
  metallization, 291
  mushroom, 407
strain-rate effects, 775, 819, 863
strength, 85, 267, 279, 385, 707, 775, 819
superconductivity, 531
surrogate material, 335

target
  aerogel, 683
  aluminum, 25, 37, 49, 61, 95, 107, 229, 255, 279, 335, 385, 395, 451, 509, 519, 587, 637, 647, 719, 729, 763, 775, 797, 819, 831, 851
  aluminum foils, 683
  aluminum oxide, 85, 491
  aluminum oxide film, 61
  aluminum--1100, 347
  aluminum--1100-0, 407, 573
  aluminum--1100-F, 607
  aluminum--2014, 73
  aluminum--2024, 73
  aluminum--2024-T3, 573, 607
  aluminum--2024-T86, 561
  aluminum--2219, 671
  aluminum--6061, 73
  aluminum--6061-T6, 133, 157, 193, 541, 573, 671
  aluminum--7039, 809
  Astroquartz, 739
  bonded adhesive joint, 279
  boron carbide, 491
  bumper shield 25, 37, 95, 133, 145, 157, 169, 193, 255, 395, 479, 519, 541, 607, 637, 671, 739
  cadmium, 335
  carbon fiber/epoxy, 279
  ceramic cloth, 145, 169, 193, 739
  ceramics, 85
  concrete, 385
  copper, 13, 279, 503, 531, 719, 775, 797, 809, 819
  dielectric ceramic, 49
  dolomite, 205
  dual-wall, 637
  energetic materials, 241
  epoxy, 719
  fullerenes, 531
  geologic materials, 267
  glass, 49
  gold, 719, 775, 797
  granite, 531
  grout, 267
  heat shield, 597
  iron, 279
  Kevlar, 95, 169
  lead, 797
  limestone, 267
  mesh, 145, 169
  microspheres, 659
  molybdenum, 797
  mylar foil, 719
  Nextel, 95, 145, 169, 193, 739
  nickel foil, 719
  particulates, 659
  perforation, 157, 325, 373, 561
  plate thickness effects, 561
  plexiglas, 13
  PMMA, 427
  polymer foams, 751
  pressure wall, 637
  propellant, 241
  pumice, 659
  PVDF foils, 683
  quartz, 531, 719
  RHA, 85, 303, 407, 809, 843
  rock, 267
  sand, 659
  semi-infinite, 1, 157, 303, 325, 407, 551, 809, 843
  semiconductor, 291
  silica phenolic/aluminum, 597
  silicon carbide, 491, 531
  silver, 797
  spaced plates, 373
  Spectra, 169
  steel, 13, 385, 831
  steel (hard), 373
  steel--4340, 1, 407, 551, 561
  steel--C45, 325
  steel--mild, 809
  Teflon foil, 631
  teflon, 347
  thickness effects, 25, 73, 157, 347, 395, 541, 561, 573, 587, 607, 797, 831
  thin film, 729
  tin, 797
  titanium, 519
  titanium diboride, 491
  TMB, 479
  transition metals, 291
  tuff, 267

zinc, 335
zinc, 797
target obliquity, 157
target resistance, 1, 85
Tate resistance, 1, 85
thermal softening, 843
thin films, 509, 531
titanium, 121
transformation strain, 291
transition metals, 291
transition pressure, 291
tungsten
see projectile

unsteady penetration, 1

vaporization, 707
see phase transformation
velocity scaling, 335, 551
void growth, 503
void size, 503

wave shaping, 181
Whipple shield
see bumper shield
witness panel, 607
witness panels, 671
witness plate
damage, 325, 831
hole diameters, 325
hole size, 831
standoff, 831
witness plates, 797
witness plates
crater ring, 797

XDT, 241

yawed impact, 373
yield stress, 291

3